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**Yadav**

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(54) **TORSION SPRING BUSHING**

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(51) **Int. Cl.**

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| ***B60N 2/44*** | (2006.01) |

(52) **U.S. Cl.**
CPC ..... ***B60N 2/1635*** (2013.01); ***B60N 2/44*** (2013.01); ***F16C 17/12*** (2013.01)

(58) **Field of Classification Search**
CPC ..... B60N 2/1635; B60N 2/44; F16C 17/12; A61G 5/1067
USPC ..... 297/344.12, 354.1, 354.11
See application file for complete search history.

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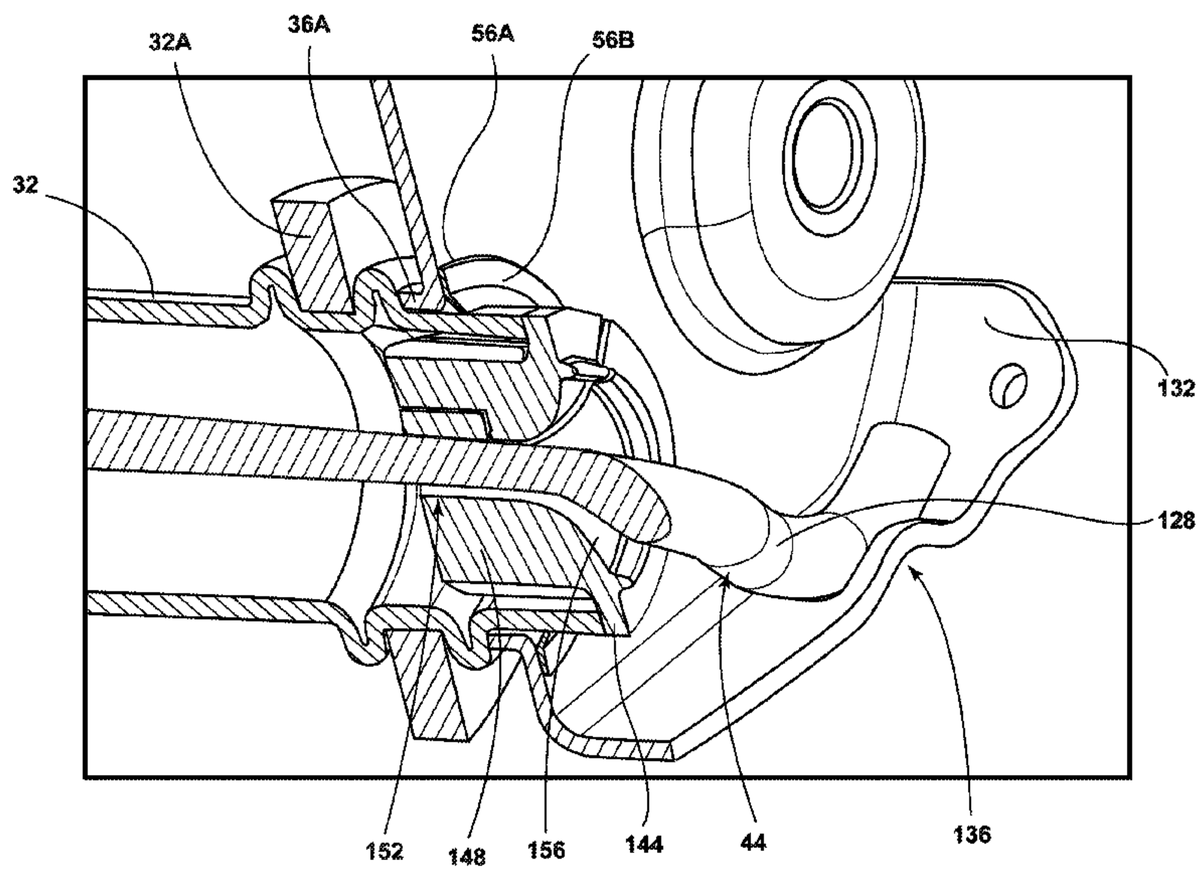
(57) **ABSTRACT**

A vehicle seating assembly is provided which includes a seat back and a seat base operably connected to the seat back. The seat base has a seat base frame that includes a torsion tube extending laterally between at least two side members. A height adjustment mechanism is disposed through at least one of the side members. A torsion spring extends within the torsion tube and is in contact with at least two side members. A torsion spring bushing is positioned around the torsion spring and extends into the torsion tube. The torsion spring bushing defines a brush configured to contact the torsion tube and a retaining ring positioned around the torsion tube. The retaining ring is in contact with at least one side member.

**20 Claims, 9 Drawing Sheets**



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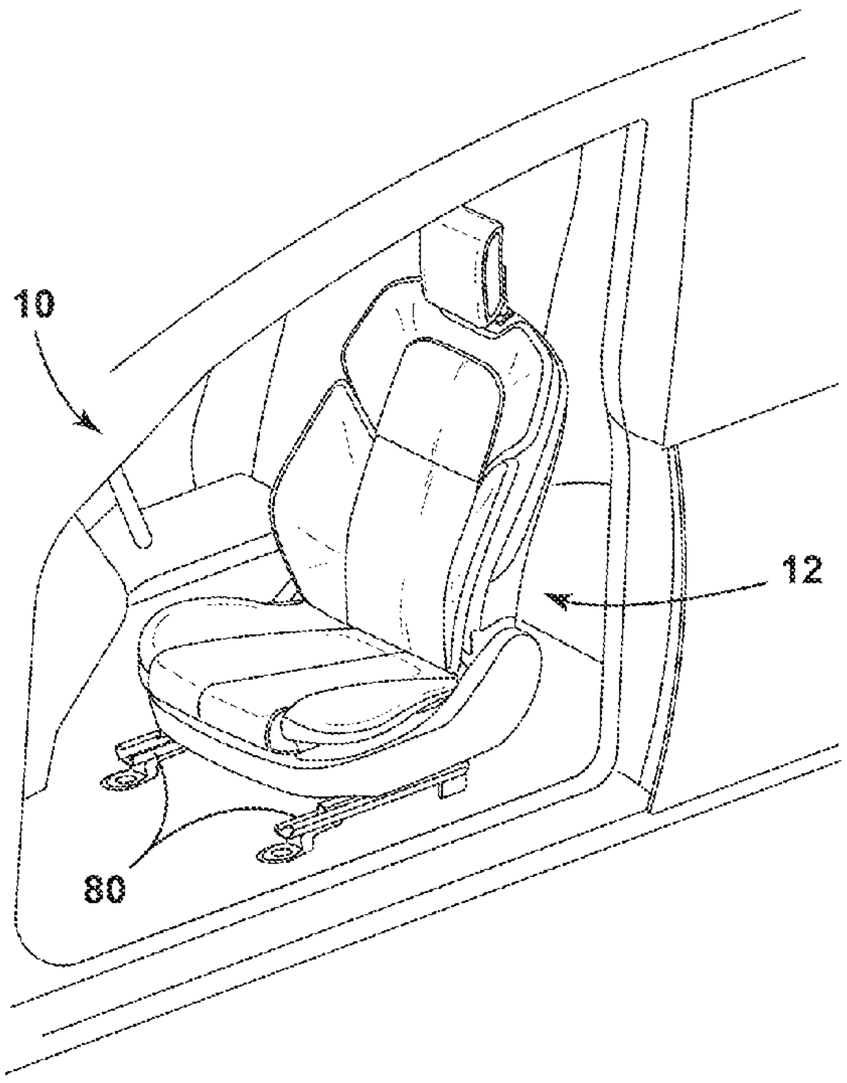


FIG. 1

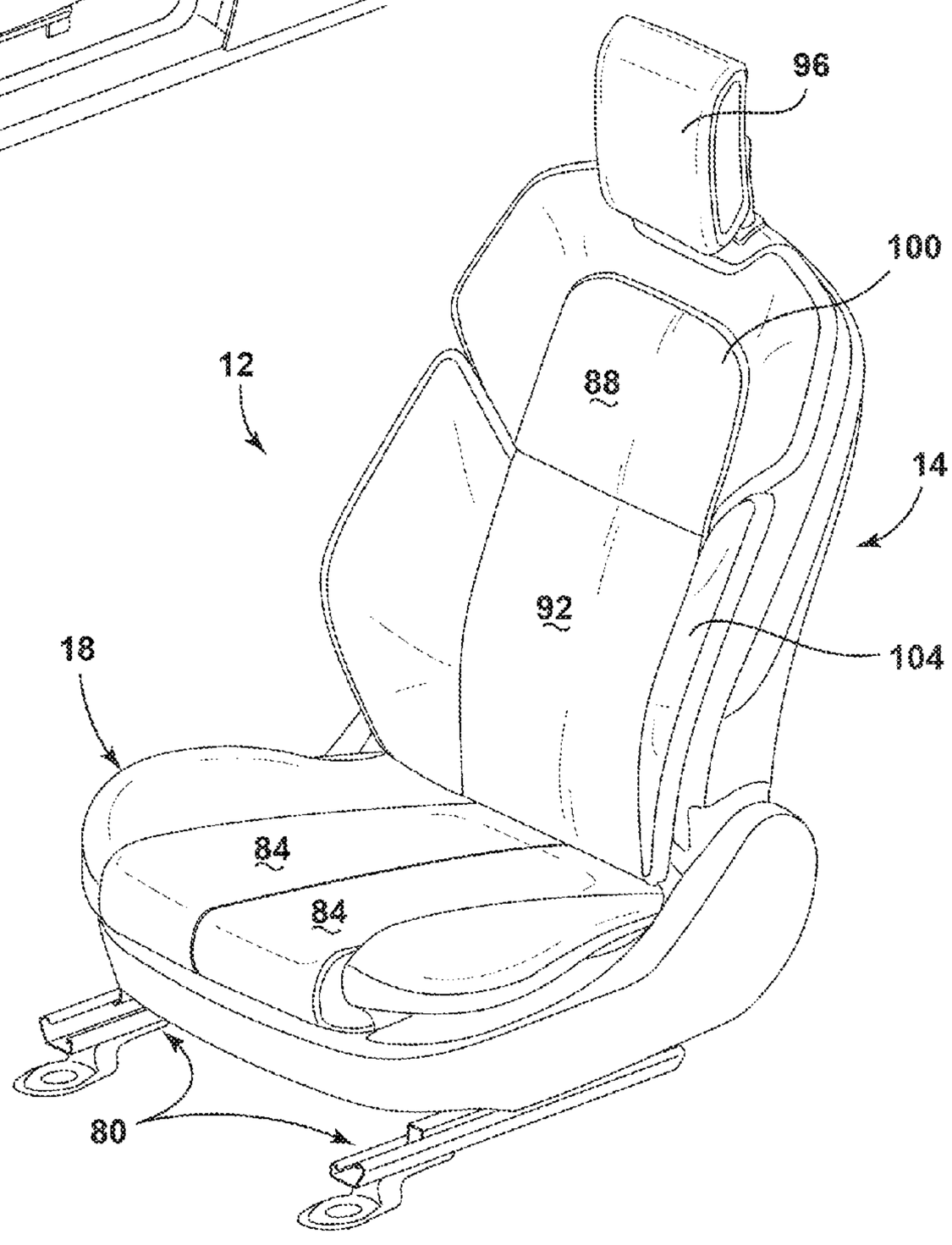


FIG. 2

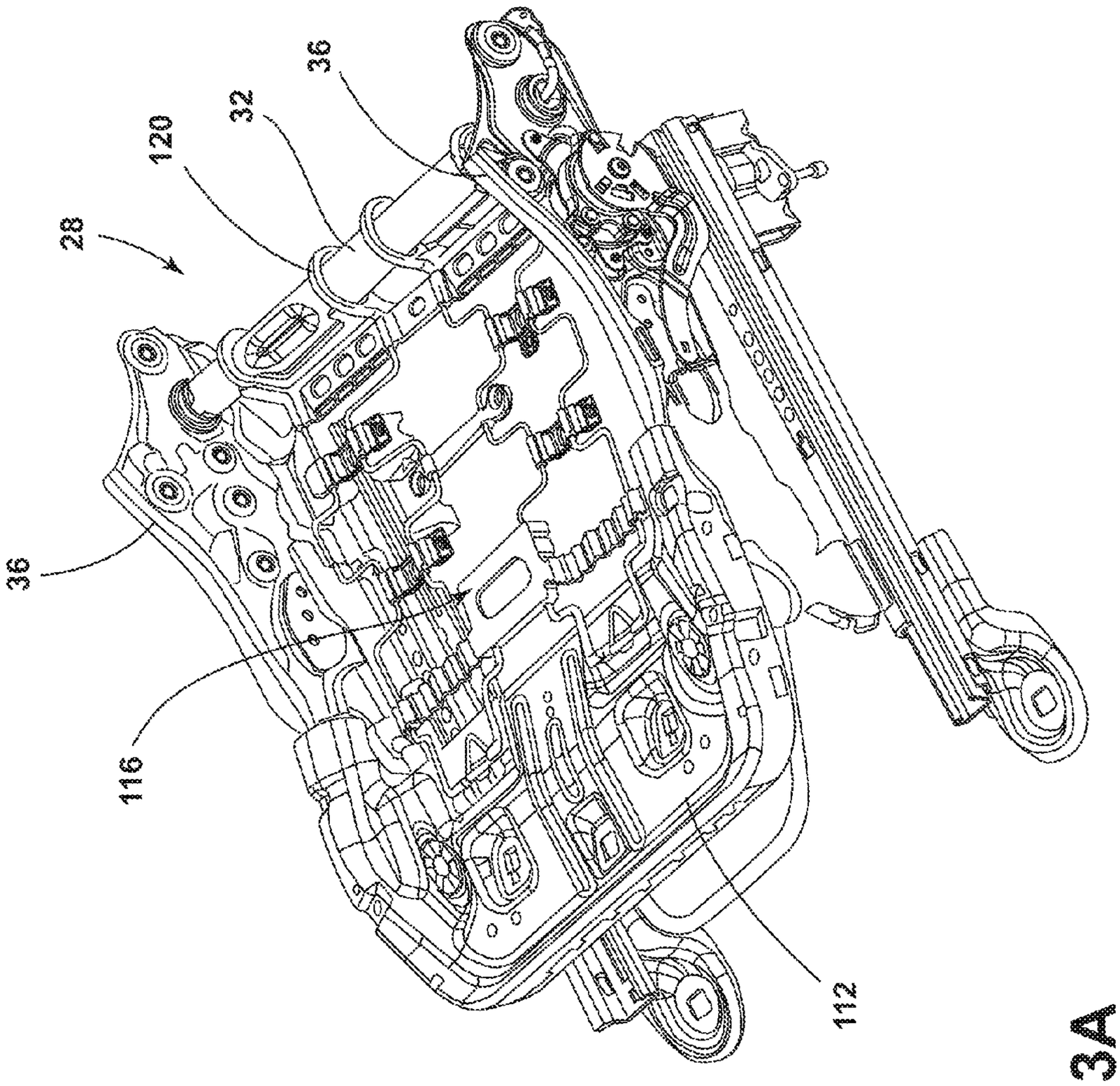


FIG. 3A

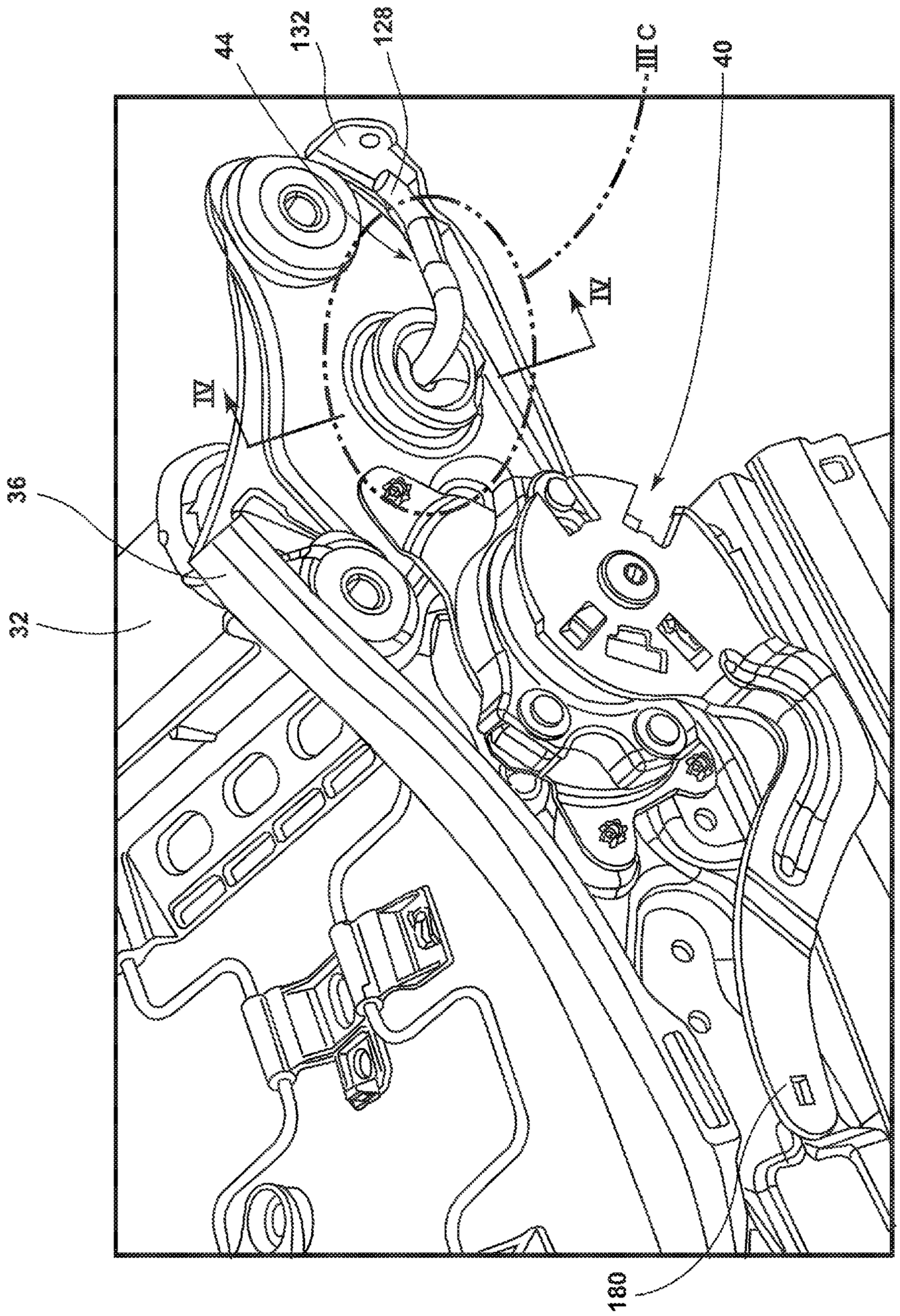


FIG. 3B

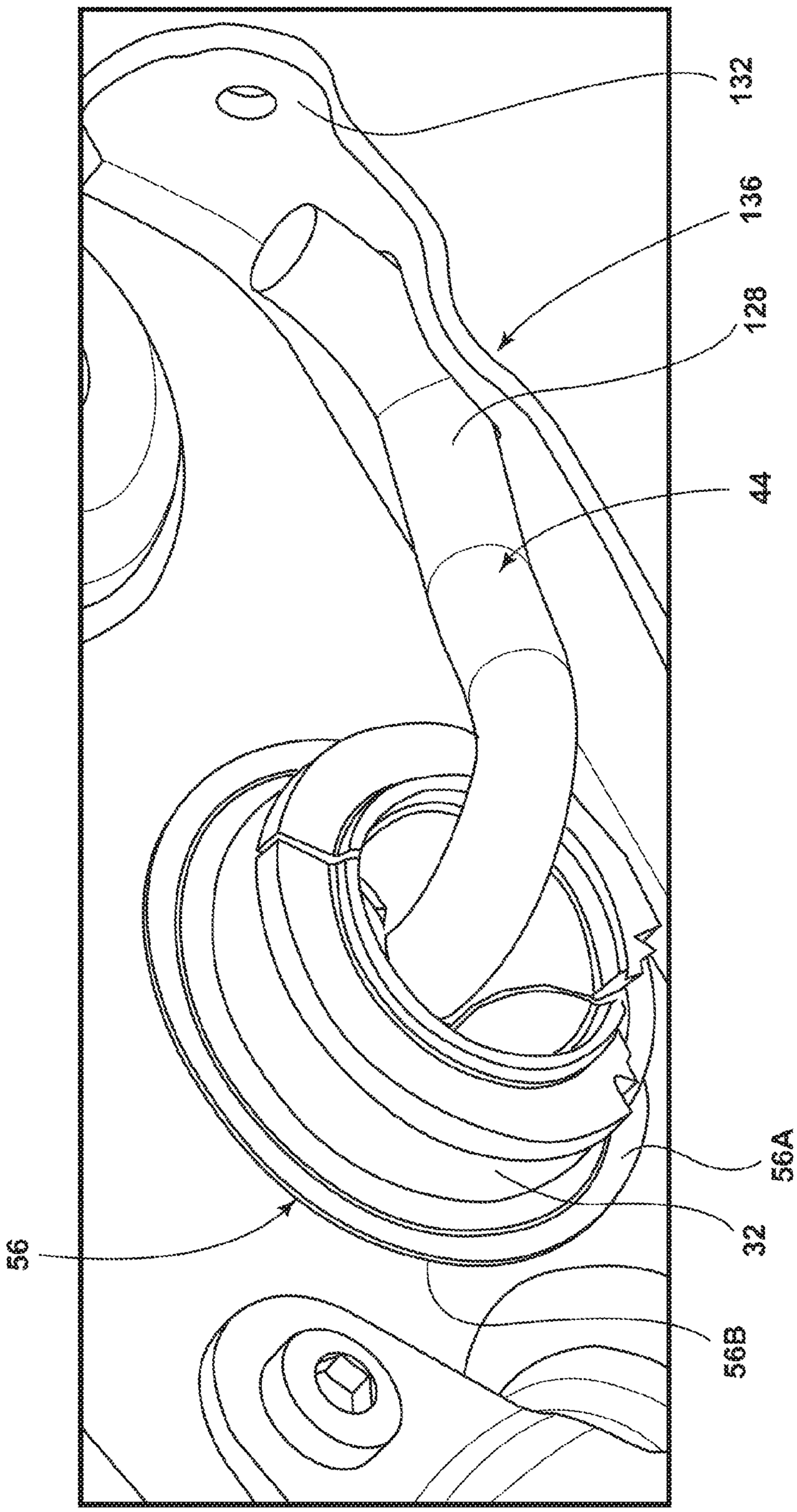


FIG. 3C

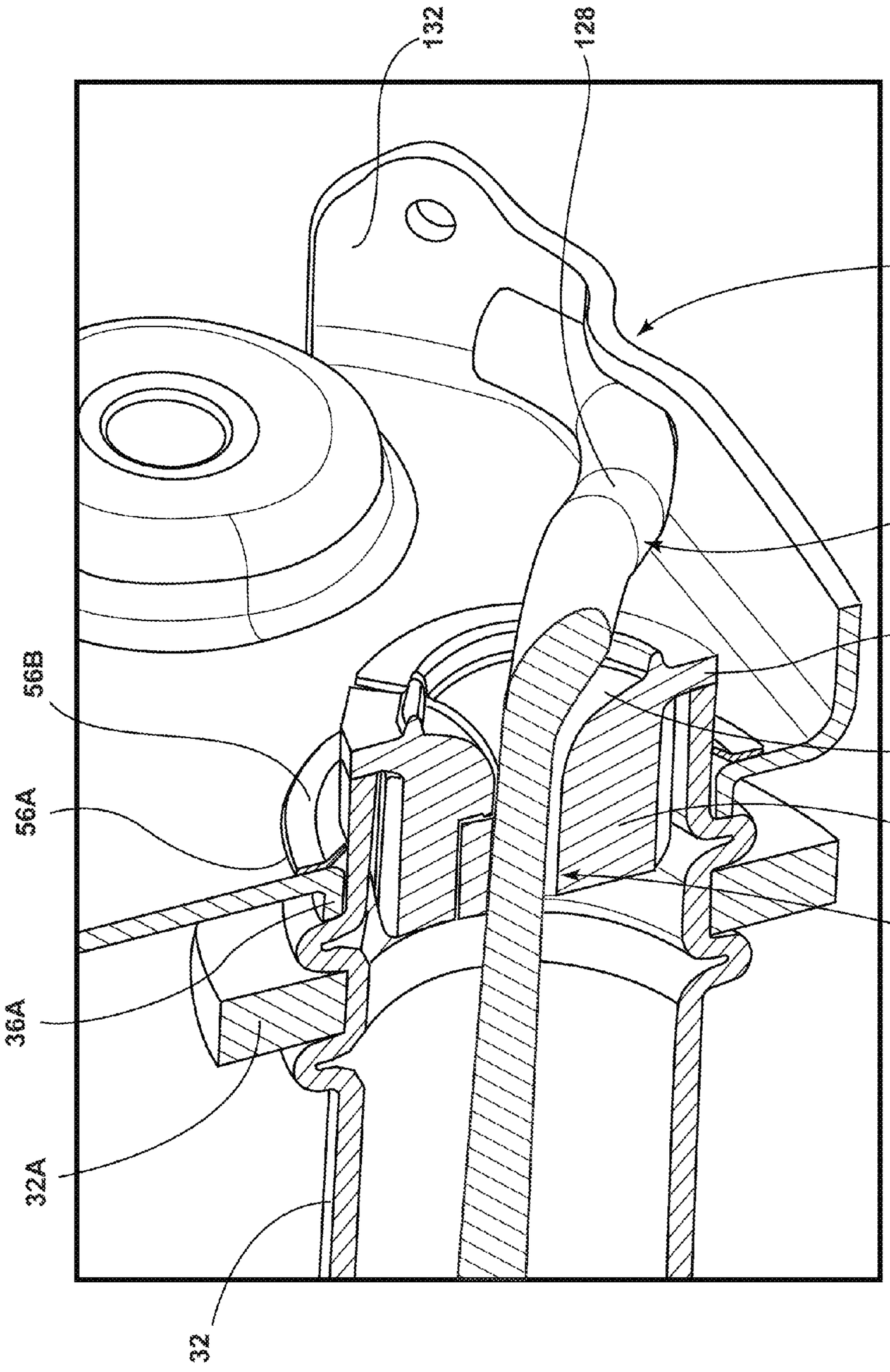


FIG. 4

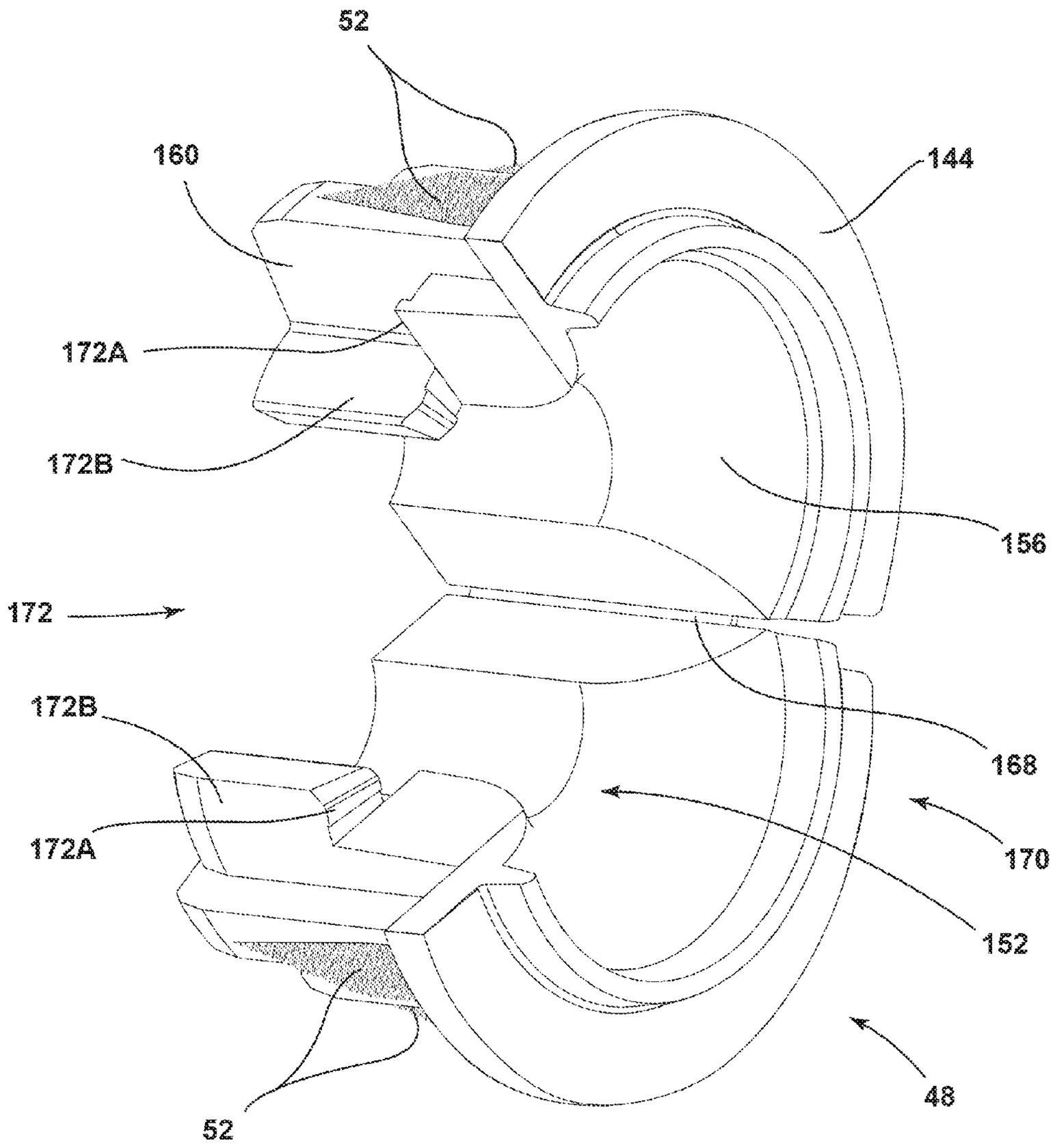


FIG. 5A

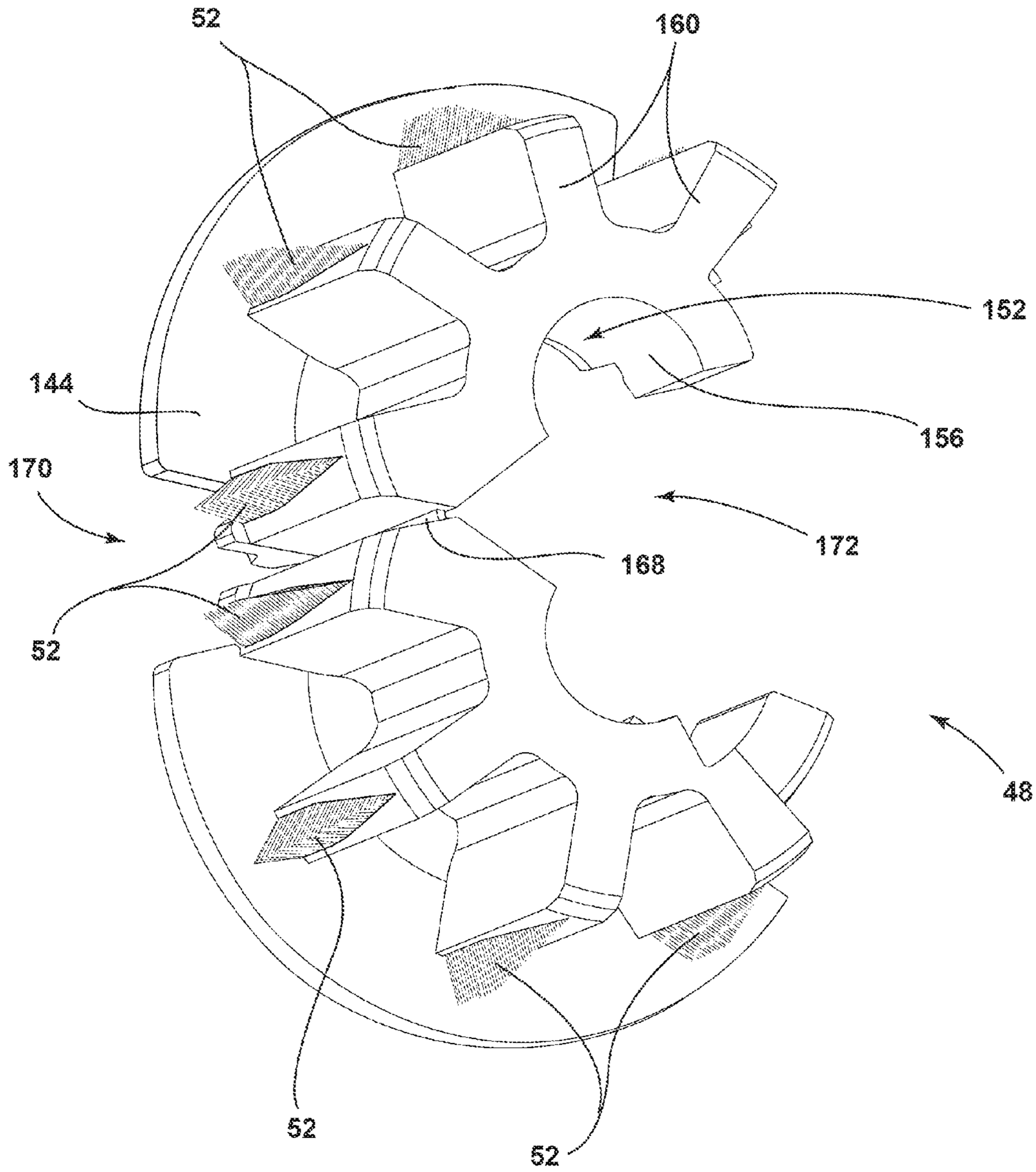


FIG. 5B

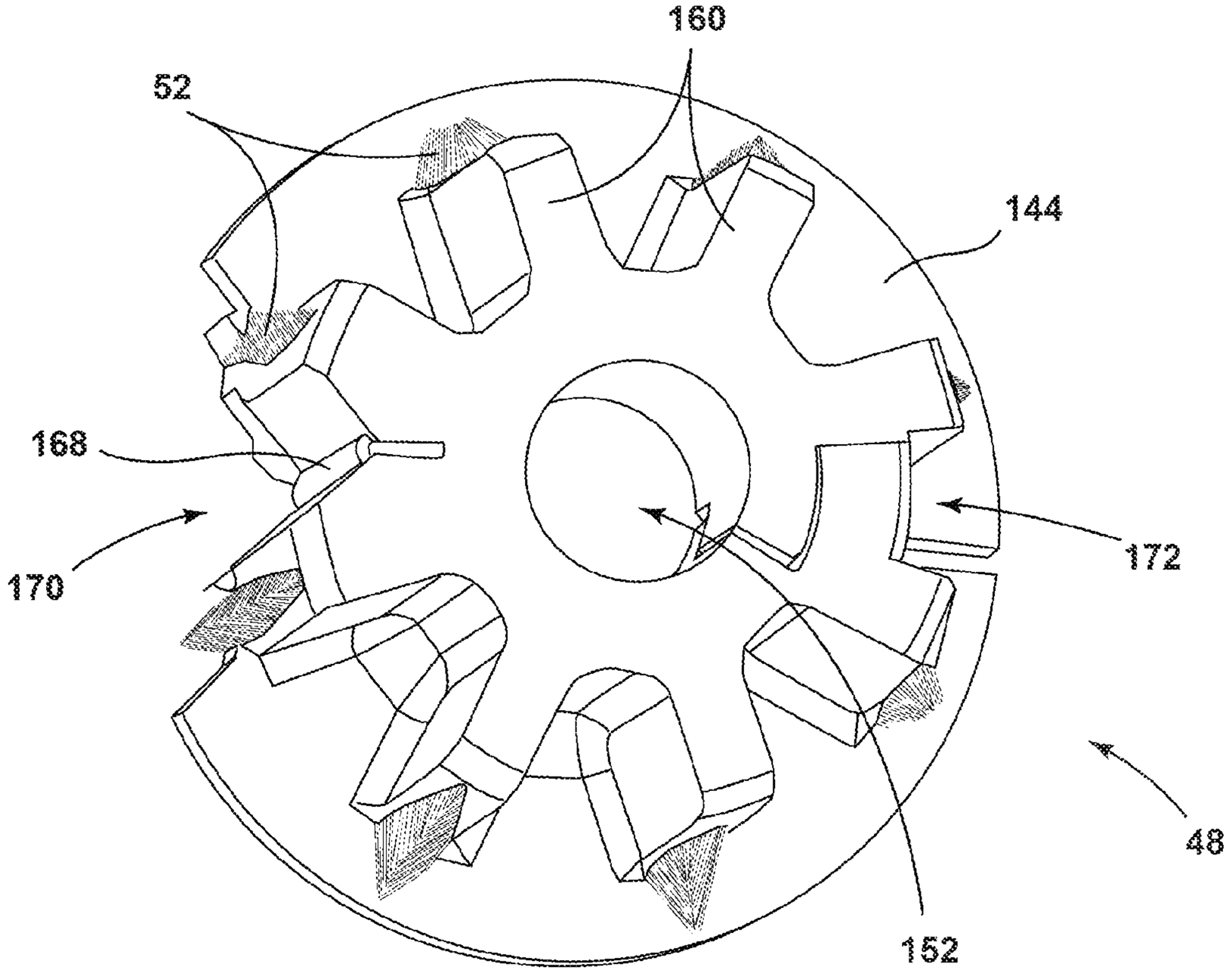


FIG. 5C

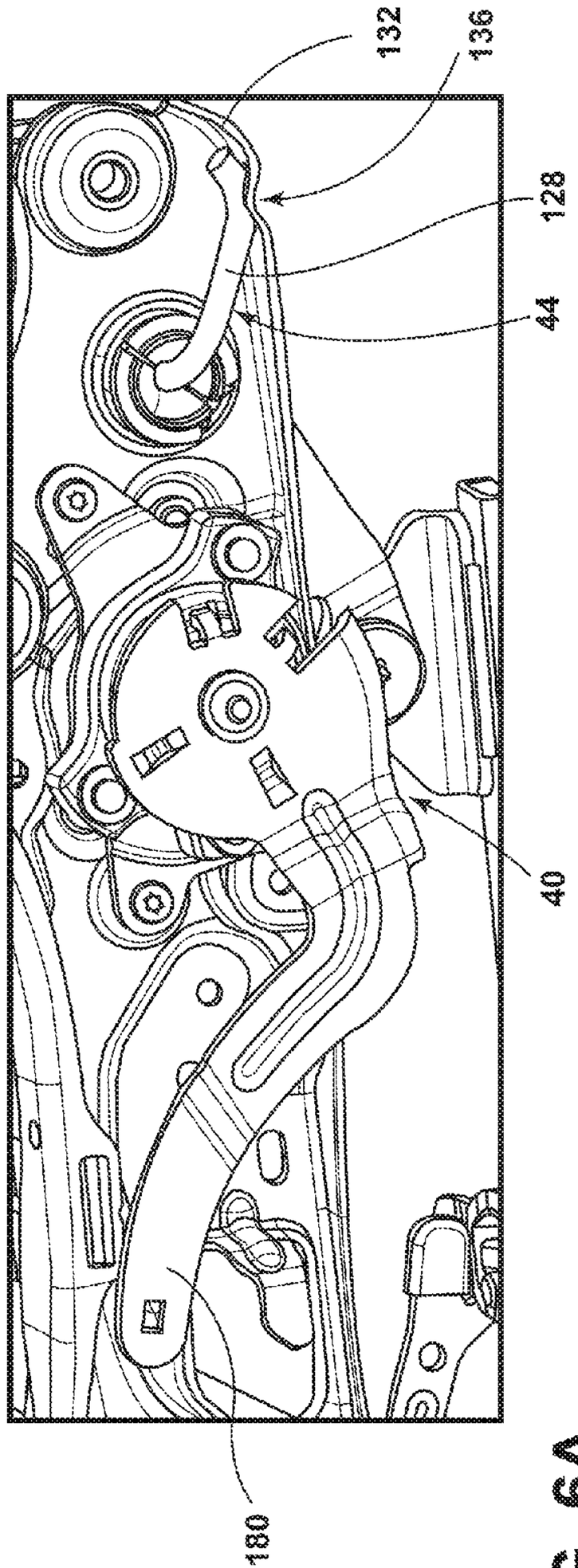


FIG. 6A

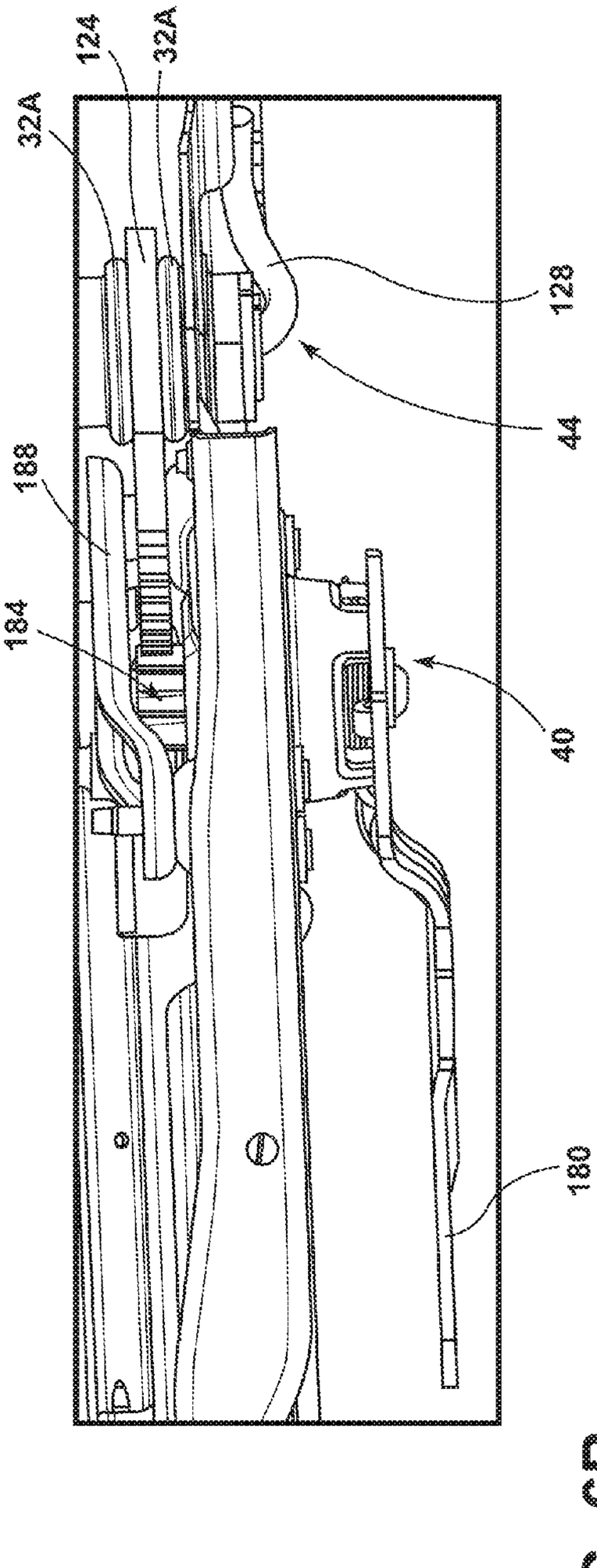


FIG. 6B

# TORSION SPRING BUSHING

## FIELD OF THE INVENTION

The present disclosure generally relates to a vehicle seating assembly, and more particularly, a torsion tube assembly disposed within a seat bottom of the seating assembly.

## BACKGROUND OF THE INVENTION

Vehicle seating assemblies may include a torsion spring disposed within a torsion tube to regulate the force for adjusting the height of the seating assembly.

## SUMMARY OF THE INVENTION

According to one aspect of the present disclosure, a vehicle seating assembly is provided that includes a seat back and a seat base operably connected to the seat back. The seat base has a seat base frame that includes a torsion tube extending laterally between at least two side members. A height adjustment mechanism is disposed through at least one of the side members. A torsion spring extends within the torsion tube and is in contact with at least two side members. A torsion spring bushing is positioned around the torsion spring and extends into the torsion tube. The torsion spring bushing defines a brush configured to contact the torsion tube and a retaining ring positioned around the torsion tube. The retaining ring is in contact with at least one side member.

According to another aspect of the present disclosure, a vehicle seat base is provided that includes a seat base frame having a torsion tube extending laterally between at least two side members. A torsion spring extends within the torsion tube and is in contact with both side members. A torsion spring bushing is positioned around the torsion spring and extends into the torsion tube. The bushing defines a plurality of brushes protruding from the bushing and configured to engage the torsion tube.

According to yet another aspect of the present disclosure, a vehicle seat base is provided that includes a seat base frame having a torsion tube extending laterally between at least two side members, a torsion spring extending within the torsion tube and a torsion spring bushing positioned around the torsion spring and extending into the torsion tube. The bushing defines a hinge and a fastener disposed on opposite sides of the bushing

These and other aspects, objects, and features of the present disclosure will be understood and appreciated by those skilled in the art upon studying the following specification, claims, and appended drawings.

## BRIEF DESCRIPTION OF THE DRAWINGS

In the drawings:

FIG. **1** is a top perspective view of a vehicle seat disposed inside a vehicle;

FIG. **2** is a top perspective view of the vehicle seat of FIG. **1**;

FIG. **3**A is a top perspective view of a seat bottom frame of the vehicle seat with a cover and padding removed;

FIG. **3**B is an enhanced view of FIG. **3**A, according to the present disclosure;

FIG. **3**C is an enhanced view taken at IIIC of FIG. **3**B, according to the present disclosure;



FIG. **4** is a cross-sectional view taken along line IV of FIG. **3**B, according to the present disclosure;

FIG. **5**A is a front perspective view of a torsion spring bushing in an open configuration, according to the present disclosure;

FIG. **5**B is a back perspective view of a torsion spring bushing in an open configuration, according to the present disclosure;

FIG. **5**C is a back perspective view of a torsion spring bushing in a closed configuration, according to the present disclosure;

FIG. **6**A depicts a side view of the seat bottom frame of FIG. **3**A, according to the present disclosure; and

FIG. **6**B depicts a top view of the seat bottom frame of FIG. **3**A, according to the present disclosure.

## DETAILED DESCRIPTION

Reference will now be made in detail to the present embodiments, examples of which are illustrated in the accompanying drawings. Whenever possible, the same reference numerals will be used throughout the drawings to refer to the same or like parts.

For purposes of description herein, the terms "upper," "lower," "right," "left," "rear," "front," "vertical," "horizontal," and derivatives thereof, shall relate to the disclosure as oriented in FIG. **1**, unless stated otherwise. However, it is to be understood that the disclosure may assume various alternative orientations, except where expressly specified to the contrary. It is also to be understood that the specific devices and processes illustrated in the attached drawings, and described in the following specification, are simply exemplary embodiments of the inventive concepts defined in the appended claims. Hence, specific dimensions and other physical characteristics relating to the embodiments disclosed herein are not to be considered as limiting unless the claims expressly state otherwise. Additionally, embodiments depicted in the figures may not be to scale or may incorporate features of more than one embodiment.

As used herein, the term "and/or," when used in a list of two or more items, means that any one of the listed items can be employed by itself, or any combination of two or more of the listed items can be employed. For example, if a composition is described as containing components A, B, and/or C, the composition can contain A alone; B alone; C alone; A and B in combination; A and C in combination; B and C in combination; or A, B, and C in combination.

Referring now to FIGS. **1-6**B, reference numeral **10** generally designates a vehicle in which a vehicle seating assembly **12** is positioned. The vehicle seating assembly **12** includes a seat back **14** and a seat base **18**. The seat base **18** is operably connected to the seat back **14**. The seat base **18** includes a seat base frame **28** having a torsion tube **32** extending laterally between at least two side members **36**. A height adjustment mechanism **40** is disposed through at least one of the side members **36**. A torsion spring **44** extends within the torsion tube **32** and is in contact with both side members **36**. A torsion spring bushing **48** positioned around the torsion spring **44** and extending into the torsion tube **32**. The torsion spring bushing **48** defines a brush **52** configured to contact the torsion tube **32**. A retaining ring **56** is positioned around the torsion tube **32**. The retaining ring **56** is in contact with at least one side member **36**.

Referring now to FIGS. **1** and **2**, the illustrated vehicle seating assembly **12** is configured for use in a vehicle of any type, including, without limitation, cars, vans, trucks, buses, etc. The vehicle seating assembly **12** is suspended on rails **80**

that allow movement of the vehicle seating assembly **12** in fore and aft directions within the vehicle **10**. In addition, the vehicle seating assembly **12** may include a variety of comfort controls, including, for example, thigh support using independent thigh supports **84**, lumbar support, and upper thoracic support. The seat back **14** includes both an upper seat back **88** and a lower seat back **92**. The vehicle seating assembly **12** includes a head restraint **96** that is disposed on the upper seat back **88**. The head restraint **96** is moveable between forward and rearward positions to accommodate various sized heads of passengers, as well as different heights of passengers. The vehicle seating assembly **12** also includes controls specifically configured to adjust an upper thoracic portion **100** of the upper seat back **88** or a lower thoracic portion **104** of the lower seat back **92**.

Referring now to FIG. **3**A, disposed within the seat base **18** (FIG. **2**) is the seat base frame **28**. As explained above, the seat base frame **28** includes the torsion tube **32** which extends between the side members **36**. The side members **36** are operably coupled to a seat pan **112** which aids in providing support to the thigh supports **84** (FIG. **2**). In some examples, the seat pan **112** may contain independently actuatable portions such that the thigh supports **84** may be moved independently of one another. Positioned in the center of the seat base frame **28** is a suspension member **116** configured to provide resiliency and support to cushion assemblies of the seat base **18**. The suspension member **116** may include a plurality of hooks **120** configured to wrap over the torsion tube **32** to support the suspension member **116**. Additionally, at least one of the side members **36** includes the height adjustment mechanism **40** (FIG. **3**B). The height adjustment mechanism **40** may be used to adjust the height of the seat base **18** relative to a floor of the vehicle **10**, as explained in greater detail below.

Referring now to FIGS. **3**B, **3**C and **4**, positioned vehicle rearward of the height adjustment mechanism **40** is the torsion tube **32**. The torsion tube **32** extends between the two side members **36**, and in the depicted example, partially extends through the side members **36**. The side members **36** define a torsion flange **36**A configured to contact a tube ridge **32**A. The contact of the tube ridge **32**A with the side flange **36**A may be used to ensure the torsion tube **32** extends a proper distance through the side members **36**. The torsion tube **32** may define a pair of torsion ridges **32**A configured to lock a torsion arm **124** (FIG. **6**B) in place. Positioned around the torsion tube **32** and in contact with the side member **36** is the retaining ring **56**. The retaining ring **56** is positioned on an opposite side of the side member **36** than the tube ridge **32**A and is proximate the side flange **36**A. The retaining ring **56** is configured to grip the torsion tube **32** such that motion of the torsion tube **32** that would tend to remove it from the side member **36** is resisted and the torsion tube **32** is retained in the side member **36**. The retaining ring **56** includes a base portion **56**A in contact with the side member **36** and an angled portion **56**B in contact with the torsion tube **32**. In the depicted example, the angled portion **56**B of the retaining ring **56** is composed of multiple parts, but may instead be a continuous structure.

Extending through the torsion tube **32** is the torsion spring **44**. The torsion spring **44** extends substantially coaxially with the torsion tube **32** and includes bent portions **128** extending substantially perpendicular to the axis of the torsion tube **32**. The torsion spring **44** may store strain energy by twisting to resist motion of the seat base **18** (FIG. **2**) up and down relative to the floor of the vehicle **10** (FIG. **1**). The bent portions **128** bend in a vehicle rearward direction and engage side flanges **132** defined by each of the side members **36**. The side flanges **132** each define a securement feature **136** configured to hold the bent portions **128** in place.

Referring now to FIGS. **4**, and **5**A-C, positioned around the torsion spring **44** is the torsion spring bushing **48**. The torsion spring bushing **48** may be composed of a polymeric material, a metal, or a composite thereof. The torsion spring bushing **48** defines a bushing lip **144** and a bushing body **148**. The bushing body **148** may have a length of between about 7.5 mm and about 30.0 mm. The bushing body **148** may be tapered on an end configured to be inserted into the torsion tube **32**. The bushing lip **144** may be a continuous structure, as depicted, or may be semi-continuous around the bushing **48** (i.e. multiple discrete portions). The bushing lip **144** may have a thickness of between about 1.0 mm and about 5.0 mm. The bushing lip **144** may have a diameter, or longest length, of between about 15 mm and about 60 mm. In a specific example, the diameter of the bushing lip **144** may be about 30 mm. The bushing body **148** is sized to be inserted into the torsion tube **32** such that an end of the torsion tube **32** is in contact with the bushing lip **144**. The torsion spring bushing **48** defines an annulus **152** through which the torsion spring **44** extends. Positioned proximate the annulus **152** is a curved conical surface **156**. The curved conical surface **156** opens with increasing distance from the annulus **152**. Defined around the bushing body **148** is a plurality of protrusions **160**. The protrusions **160** are tall, thin, structures which extend outwardly toward the torsion tube **32**. The protrusions **160** may extend radially outward as far as the bushing lip **144**, or may be smaller. In the depicted example, the bushing body **148** defines eight protrusions **160**, but the body **148** may define between 2 and 16 protrusions **160**. The bushing body **148**, including the protrusions **160**, may have a diameter of between about 10 mm and about 40 mm.

Positioned around the bushing body **148** is a plurality of brushes **52**. The brushes **52** are positioned on top of the protrusions **160**. The brushes **52** may extend the length of the bushing body **148** and protrusions **160**, only a portion of the length or may have an intermittent spacing or placement along the length of the body **148**. The brushes **52** may have a length along the protrusions of between about 6.0 mm and about 20 mm. The brushes **52** may have a height of between about 1.0 mm and about 4.0 mm. Each of the brushes **52** include a plurality of fibers extending radially outward from the protrusion **160**. The fibers of the brushes **52** may be integrally defined by the protrusions **160** or may be applied thereto. The fibers may be composed of the same material as the bushing **48**, or may be a different material. For example, the fibers may be composed of a polymeric material, a natural material, or composite thereof. The brushes **52** may be flexible and capable of being pressed against the bushing body **148** and an inside surface of the torsion tube **32**. The brushes **52** may be equally spaced around the bushing body **148** or may be positioned in another pattern or irregular spacing. In examples where the bushing lip **144** is a discontinuous structure, the brushes **52** may be positioned between the brushing lips **144**. The brushes **52** may taper in width along the bushing body **148** (i.e. have more or less fibers or have a less or more dense spacing).

The brushes **52** are configured to provide an interference fit between the torsion spring bushing **48** and the torsion tube **32**. The flexibility of the brushes **52** allow the brushes **52** to fill a space formed between the bushing body **148** and an inner surface of the torsion tube **32**. The brushes **52** are configured to create friction between the torsion tube **32** and the torsion spring bushing **48** such that lateral motion of the

bushing **48** out of the tube **32** is resisted. Additionally, the interference fit between the torsion spring bushing **48** and the torsion tube **32** resists rotational movement of the bushing **48** within the torsion tube **32**. In some examples, the inner surface of the torsion tube **32** may be roughened. In such examples, the roughened inner surface of the torsion tube **32** may generate a greater friction between the torsion tube **32** and the brushes **52** of the torsion spring bushing **48** thereby generating a stronger interference fit.

The torsion spring bushing **48** is configured to be operated between substantially open (FIGS. **5**A and **5**B) and substantially closed (FIG. **5**C) configurations. The torsion spring bushing **48** includes a hinge **168** which allows the bushing **48** to rotate between the open and closed positions. In various examples, the hinge **168** may be a living hinge. The hinge **168** is positioned between two of the protrusions **160**. Disposed around the hinge **168** is an alignment feature **170**. In other examples, the alignment feature **170** may be formed anywhere around the torsion spring bushing **48**. The alignment feature **170** may be formed in the bushing lip **144** as a general V-shaped opening. The torsion tube **32** may include one or more indicia (e.g., engraving and/or markings) which may be aligned with the alignment feature **170**. The V-shaped opening of the alignment feature **170** may have an angular extent greater than about 20°, 30°, 40°, 50°, 60°, 70°, 80°, 90°, or 100°. In a specific example, the indicia and the alignment feature **170** may cooperate to define a general "arrow" shape. Such use of the indicia and the alignment feature **170** may allow the torsion spring bushing **48** to be quickly, and accurately, placed during assembly. In the depicted example, disposed on an opposite side of the torsion spring bushing **48** is a bushing fastener **172**. The bushing fastener **172** includes opposing ridges **172**A on opposing flanges **172**B. The opposing ridges **172**A are configured to snap together as the torsion spring bushing **48** is rotated to the substantially closed position around the torsion spring **44**. It will be understood that in alternate examples, the torsion spring bushing **48** may not include the hinge **168**, but rather include a similar bushing fastener **172** where the hinge **168** is depicted. In such an example, the torsion spring bushing **48** may be in two pieces until assembled (e.g., clicked together) around the torsion spring **44**.

Referring now to FIGS. **6**A and **6**B, the height adjustment mechanism **40** includes a handle **180** configured to rotate a gear **184** in contact with the torsion arm **124**. The torsion arm **124** defines a plurality of teeth **188** configured to engage with the gear **184** such that rotation of the gear **184** (e.g., through motion of the handle **180**) causes the torsion arm **124** to move along the gear **184**. Movement of the torsion arm **124** causes the height of the seat base **18** (FIG. **2**) to increase or decrease. As explained above, the torsion spring **44** may store strain energy to regulate the force needed for upward or downward motion of the seat base **18**.

Various advantages may be gained through the use of the present disclosure. For example, use of the brushes **52** may prevent the force needed to increase the height of the seat base **18** from increasing over time. In traditional systems, bushings in torsion tubes may undergo rotational and lateral movement out of the tube, thereby contacting the torsion spring. As the bushing moves out of the torsion tube, increasing contact with the torsion spring may increase the force necessary to adjust the height of the seat. However, use of the brushes **52** may create an interference fit between the torsion spring bushing **48** and the torsion tube **32** such that the bushing **48** is resisted from negatively impacting the torsion spring **44**. Additionally, use of the bushing fastener **172** and/or the hinge **168** may allow for quick and easy assembly of the bushing **48** around the torsion spring **44**. Further, the alignment feature **170** may allow fast and accurate placement of the bushing **48** in the torsion tube **32**.

It is to be understood that variations and modifications can be made on the aforementioned structure without departing from the concepts of the present disclosure, and further it is to be understood that such concepts are intended to be covered by the following claims unless these claims by their language expressly state otherwise.

What is claimed is:

**1**. A vehicle seating assembly comprising:

a seat back; and

a seat base operably connected to the seat back, the seat base having a seat base frame comprising:

a torsion tube extending laterally between at least two side members;

a height adjustment mechanism disposed through at least one of the side members;

a torsion spring extending within the torsion tube and in contact with at least two side members;

a torsion spring bushing positioned around the torsion spring and extending into the torsion tube, the torsion spring bushing comprising a brush configured to contact the torsion tube; and

a retaining ring positioned around the torsion tube, the retaining ring in contact with at least one side member.

**2**. The vehicle seating assembly of claim **1**, wherein the torsion spring bushing comprises a polymeric material.

**3**. The vehicle seating assembly of claim **1**, wherein the retaining ring defines an angled portion.

**4**. The vehicle seating assembly of claim **1**, wherein the torsion spring bushing is configured to center the torsion spring within the torsion tube.

**5**. The vehicle seating assembly of claim **1**, wherein the torsion spring bushing defines a plurality of brushes.

**6**. The vehicle seating assembly of claim **5**, wherein the plurality of brushes are configured to resist lateral and rotational movement of the torsion spring bushing within the torsion tube.

**7**. A vehicle seat base comprising:

a seat base frame having a torsion tube extending laterally between at least two side members;

a torsion spring extending within the torsion tube and in contact with both side members; and

a torsion spring bushing positioned around the torsion spring and extending into the torsion tube, the torsion spring bushing comprising a plurality of protruding brushes configured to engage the torsion tube.

**8**. The vehicle seat base of claim **7**, wherein the bushing defines an annulus around which a plurality of protrusions is defined.

**9**. The vehicle seat base of claim **8**, wherein the plurality of brushes are positioned on the plurality of protrusions.

**10**. The vehicle seat base of claim **7**, wherein the plurality of brushes are equally spaced on the torsion spring bushing.

**11**. The vehicle seat base of claim **7**, wherein the plurality of brushes extend on the torsion spring bushing laterally relative to the torsion tube.

**12**. The vehicle seat base of claim **7**, wherein each of the plurality of brushes comprise a plurality of fibers.

**13**. The vehicle seat base of claim **12**, wherein the plurality of fibers comprise a polymeric material.

**14**. A vehicle seat base comprising:

a seat base frame having a torsion tube extending laterally between at least two side members;

a torsion spring extending within the torsion tube; and

a torsion spring bushing positioned around the torsion spring and extending into the torsion tube, the torsion spring bushing comprising a hinge and a fastener disposed on opposite sides of the torsion spring bushing.

**15**. The vehicle seat base of claim **14**, wherein the hinge of the torsion spring bushing is configured to allow the bushing to open and close.

**16**. The vehicle seat base of claim **14**, wherein the hinge of the bushing is a living hinge.

**17**. The vehicle seat base of claim **14**, further comprising:

an alignment feature defined by the torsion spring bushing, wherein the hinge is positioned within the alignment feature.

**18**. The vehicle seat base of claim **14**, wherein the alignment feature is generally V-shaped.

**19**. The vehicle seat base of claim **18**, wherein the fastener a snap feature.

**20**. The vehicle seat base of claim **14**, wherein the bushing defines an annulus having a curved conical shape.

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